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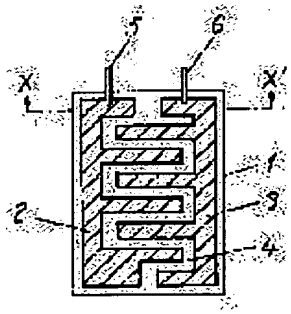
(71)Applicant : MATSUSHITA ELECTRIC IND CO LTD
(72)Inventor : FURUYAMA SHIZUO
MORIMOTO KOICHI
HASEGAWA HIROSHI

(54) TEMPERATURE-SENSITIVE SENSOR AND ELECTRONIC APPARATUS USING THE SAME

(57)Abstract:
PROBLEM TO BE SOLVED: To obtain a temperature-sensitive sensor of a small specific resistivity and a high reliability by dispersing at a temperature-sensitive layer, a conductive powder to a mixture of a copolymer resin of a flexible monomer, a hydrophobic monomer and a monomer having a glycidyl group and a setting agent.
SOLUTION: A temperature-sensitive film 4 is formed on an insulating substrate 1 having electrodes 2, 3. The temperature-sensitive film 4 is obtained by adding a setting agent to a flexible resin and dispersing a conductive powder. The flexible resin is an epoxy resin obtained by using a tetrahydrofurfuryl (metha) acrylate and copolymerizing a vinyl monomer with a vinyl monomer having an epoxy group (glycidyl methacrylate). Moreover, the setting agent for the epoxy resin is used to improve a reproducibility. An addition quantity of the conductive particles is in a range of approximately 30-50 V% to a quantity of the resin. A rate of change decreases when the quantity exceeds an optimum value and, an initial resistance value rises to worsen a recovery efficiency if the quantity is small. A temperature-sensitive sensor of a high performance and a high reliability is thus obtained.



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CLAIMS

[Claim(s)]
[Claim 1] The resin to which it comes to carry out copolymerization of the monomer which has flexibility, the monomer which has hydrophobicity, and the monomer which has a glycidyl group, and the therms sensor in which the temperature-sensitive layer which distributed conductive powder into the mixture of a curing agent was formed.
[Claim 2] The therms sensor according to claim 1 characterized by the monomer which has flexibility being tetrahydrofurfuryl acrylate or methacrylate.
[Claim 3] The therms sensor according to claim 1 characterized by being the acrylate or methacrylate in which the monomer which has hydrophobicity contains a fluorine.
[Claim 4] The therms sensor according to claim 1 characterized by the monomer which has a glycidyl group being glycidyl acrylate or glycidyl methacrylate.
[Claim 5] The therms sensor according to claim 1 characterized by a curing agent being a curing agent for epoxy resins.
[Claim 6] The therms sensor according to claim 1 characterized by conductive powder being metal powder.
[Claim 7] Electronic equipment using a therms sensor according to claim 1.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the electronic equipment using the therms sensor and it from which resistance changes according to a temperature change.
[0002]
[Description of the Prior Art] In the circuit of electronic equipment, such as a personal computer, use of the thermistor with which resistance increases rapidly at the temperature which exists in order to prevent an overcurrent, and a thermo-sensitive device is increasing. Furthermore, it is used also for the overheating breakage prevention at the time of short of a rechargeable battery. Since it carries in small electronic equipment in it, the carbon / polyethylene composite indicated by the U.S. Pat. No. 4,238,812 specification are put in practical use by small and the field to be chip-ized.
[0003]
[Problem(s) to be Solved by the Invention] When carbon was made into an electric conduction particle, since specific resistance was high compared with a metal, it was difficult to apply to the power circuit which uses a high current, and a component with more low specific resistance was desired.
[0004] A production process is still easier and the request to the component of high-reliability and low cost is also strong. This invention tends to offer the electronic equipment by which specific resistance used the therms sensor of high-reliability and low cost, and its therms sensor small, in order to solve the above-mentioned technical problem.
[0005]
[Means for Solving the Problem] This invention offers the thermo-sensitive device which can be manufactured by the simple method of carrying out spreading afterbaking hardening of the coating which distributed conductive powder on a substrate.
[0006] The electric conduction mechanism holds the condition of low resistance with much contact of the distributed electric conduction particles below with the glass transition temperature of (1) polymer. (2) If temperature rises and glass transition temperature is exceeded, expansion of a polymer became large and consist of contact of electric conduction particles decreasing. When glass transition temperature is exceeded and temperature rises further, contact of electric conduction particles decreases extremely and will be in a high resistance condition. And if it returns to a room temperature, it will return to the original contact condition by contraction of a polymer, and will return to the condition of low resistance.
[0007] In order to fulfill such a property, the binder system for therms sensors used by this invention must have glass transition temperature near 100-150 degree C, and its expansion coefficient more than glass transition temperature must be twice [more than] as large as the time of a room temperature. It cannot be overemphasized that it is required to excel in the return nature at the time of a temperature fall furthermore, and to excel in dispersibility with an electric conduction particle and the adhesive property over various substrates.
[0008] this invention persons do their best in development of the flexible polymer which fills these the demands of many wholeheartedly, and reach this invention. That is, if required, the monomer which has tetrahydrofurfuryl (meta) acrylate and a glycidyl group, and the new polymer to which copolymerization of the fluorine content monomer was carried out will be made to distribute an electric conduction particle, the curing agent for epoxy resins is added, and it considers as a coating. A therms sensor with sufficient repeatability can be manufactured by carrying out spreading afterbaking hardening on a substrate.

[0009]
[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained using an attached drawing.
[0010] (Gestalt 1 of operation) The plan in which drawing 1 shows the gestalt of 1 operation of the therms sensor of this invention, and drawing 2 are these sectional views.
[0011] The electrode of Kushigata which consists of an insulating substrate which 1 becomes from a ceramic etc., and silver prepared as phase opposite carried out in 2 and 3 on an insulating substrate 1 in drawing 1 and drawing 2 , and 4 are the temperature-sensitive film formed on the insulating substrate 1 in which these electrodes 2 and 3 were formed, and this temperature-sensitive film 4 adds a curing agent to the flexible polymer of this invention, and has the composition of having made this distributing conductive powder. 5 and are the leads connected to the above-mentioned electrodes 2 and 3.
[0012] By using the temperature-sensitive film 4 which made the flexible polymer distribute conductive powc as mentioned above, it detects as change of the contact resistance between the conductive powder which had expansion by the temperature change of a flexible polymer, and contraction distributed, i.e., electric resistance
[0013] It was found out by using tetrahydrofurfuryl (meta) acrylate as indicated by JP,62-22097,B as flexible resin of the temperature-sensitive film 4, and the new epoxy resin to which copolymerization of the vinyl monomer which has an epoxy group in a vinyl monomer was carried out being suitable, and using the curing agent for epoxy resins further with the above-mentioned configuration, that repeatability is acquired. this invention persons result in this invention the therms sensor which has the combination of the new resin systen in which resistance increases rapidly among 100 degrees C - 150 degrees C, and an electric conduction particl as a result of continuing examination wholeheartedly.
[0014] The description is in the point of applying and drying, stiffening new flexible resin on the substrate which formed the electrode after adding and coating-izing a curing agent and an electric conduction particle, and obtaining a temperature sensitivity paint film. According to this producing method, it becomes possible tc realize a miniaturization and low cost. In order to increase hydrophobicity if needed furthermore, copolymerization of the fluorine content monomer can be carried out. As a monomer of a polymer raw materi which gives the flexibility used in this invention, although tetrahydrofurfuryl (meta) acrylate is possible, tetrahydrofurfuryl methacrylate is more more desirable from a copolymeric point. As a vinyl monomer which has an epoxy group, glycidyl (meta) acrylate etc. is suitable for the vinyl monomer. The compound which contains 2-5 fluorines per monad as acrylate (meta) containing a fluorine, and the compound which has 3-4 pieces preferably are chosen. Trifluoro ethyl (meta) acrylate, tetrafluoro propyl (meta) acrylate, pentafluoro propyl (meta) acrylate, etc. are specifically raised as a fluorine content compound.
[0015] In order to give flexibility further, it is also possible to add aliphatic series (meta) acrylate, such as oth monomers, for example, tetrahydrofurfuryl (meta) acrylate, 2-ethylhexyl (meta) acrylate, lauryl (meta) acryla and tridecyl (meta) acrylate. Although it is fundamentally [all] usable if it is a curing agent for epoxy resins a curing agent, aromatic series diamine, 4 [for example,], and 4'-diamino diphenylmethane, aliphatic series diamine, 1 [for example,], 12-diamino dodecane, etc. are used preferably. Furthermore, aromatic series diamine and aliphatic series diamine may be used together. As conductive powder, those mixture can be used for metal powders, such as silver dust and copper powder, and a pan. 3-5-micron spherical powder of particle size is preferably desirable 1 microns or more at 10 microns or less. The shape of a flake and dendritic power can also be added for the repeatability of resistance.
[0016] The addition of an electric conduction particle is chosen by 30 - 50V% of within the limits to the amou of resin, takes into consideration resistance, its desired rate of a temperature change, and desired return nature and is determined. If an optimum value is exceeded, rate of change will fall, and if few, while initial resistanc will go up, the return nature to a temperature change worsens. After being easy to add the resin of the above-mentioned presentation, an electric conduction particle, a curing agent, and the solvent of the need minimal dose and making it distribute, on the electrodes 2 and 3 of Kushigata beforehand prepared on the insulating substrate 1, the laminating of the therms sensor of this invention is carried out, it carries out heat hardening, a is manufactured. Thus, as electrodes 2 and 3 of the therms sensor obtained, a conductive paste and the usual electrode material can be used.
[0017] Hereafter, this invention is explained using a still more concrete example.
[0018]

[Example] (Example 1) Azobisisobutyronitril (azobisuisobutironitoriru) 0.5g was dissolved in cyclohexanone 106.5g as tetrahydrofurfuryl acrylate 62.48g, glycidyl methacrylate 8.54g, and a polymerization initiator, in the nitrogen air current, it heats for 5 hours, copolymerization was carried out, and 80 degrees C of polymer solutions were obtained. Spherical silver dust (3-4 microns of mean diameters)g [8] and 4 and 4'-diamino diphenylmethane (DDM) 0.2g may be added to 4.5g (40 % of the weight of solid content concentration) of this resin solution as a conductive particle, and it mixes. Next, kneading distribution is enough carried out with 3 rolls, and it considers as a paste. The paste obtained on the insulating substrate of the ceramic in which the Kushigata silver electrode shown in drawing 1 R> 1 was formed was applied, heat hardening was carried out at 150 degrees C for 1 hour, and the therms sensor was produced.
[0019] The temperature-sensitive property of a therms sensor is shown in drawing 3 . An axis of abscissa is [an axis of ordinate] the resistance between terminals at temperature. The curve of A is the temperature-sensitive property of an example 1.
[0020] (Example 1 of a comparison) 8g (mean particle diameter of 3-4 microns) of spherical silver dust may be added as an epoxy resin as Epicoat 806 (oil-ized Shell Epoxy company trade name) 1.25g, DDM0.75g of a curing agent, and a conductive particle, and it mixes. Next, after carrying out kneading distribution with 3 rolls, the therms sensor was produced like the example 1. In addition, thickness was applied so that it might become almost equivalent. B curve of drawing 3 is the temperature-sensitive property of the example 1 of a comparison.

[0021] (Example 2) azobisuisobutironitoriru0.58g was dissolved in cyclohexanone 77.57g as tetrahydrofurfuryl methacrylate 57.87g, tetrafluoro ethyl methacrylate 11.16g, glycidyl methacrylate 8.54g, and a polymerization initiator, in the nitrogen air current, it heats for 5 hours, copolymerization was carried out, and 80 degrees C of polymer solutions were obtained.
[0022] 8.3g (3-4 microns of mean diameters) of spherical silver dust and DDM0.21g may be added as a conductive particle, benzyl alcohol 0.8g may be added to 2.98g (50 % of the weight of solid content concentration) of this resin solution as a solvent, and it mixes. Next, kneading distribution is enough carried out with 3 rolls, and it considers as a paste. The therms sensor was produced like the example 1 using this paste.
[0023] It was 1%, when it was left in the tub of 95% of relative humidity RH for 24 hours and the resistance R/C was evaluated, in order to see the change in resistance by moisture absorption of the produced therms sensor.
[0024] (Example 2 of a comparison) azobisuisobutironitoriru0.58g was dissolved in cyclohexanone 76.62g as tetrahydrofurfuryl methacrylate 68.08g, glycidyl methacrylate 8.54g, and a polymerization initiator, in the nitrogen air current, it heats for 5 hours, copolymerization was carried out, and 80 degrees C of polymer solutions were obtained.
[0025] The therms sensor was produced like the example 2 using this resin solution (50 % of the weight of solid content concentration). The rate of a change in resistance by moisture absorption of this therms sensor was 3%.
[0026] it is clearer than drawing 3 the rate's [of a change in resistance] by the temperature of the therms sensor of an example 1 for it to be markedly alike and to excel compared with the case of the example 1 of a comparison. This originates in the difference in a flexible polymer. Furthermore, in the example 2, since it has the fluorine atom in polymer intramolecular, and hygroscopicity becomes small from the example 2 of a comparison, the resistance rise is small.
[0027] As stated above, the therms sensor of this invention is the unique temperature-sensitive sensor that it can manufacture by the engine performance, dependability, and printing.
[0028] Although the characterization of this invention carried out about the paint film on the Kushigata electrode, the same effectiveness was acquired also by sandwich structure.
[0029]
[Effect of the Invention] This invention offers the therms sensor of low cost with high performance and high-reliability as mentioned above by applying and carrying out heat hardening of the paste which made the new flexible epoxy resin contain spherical electric conduction metal particles.

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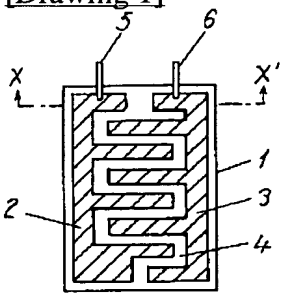
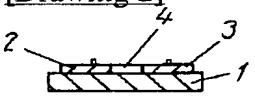
DRAWINGS

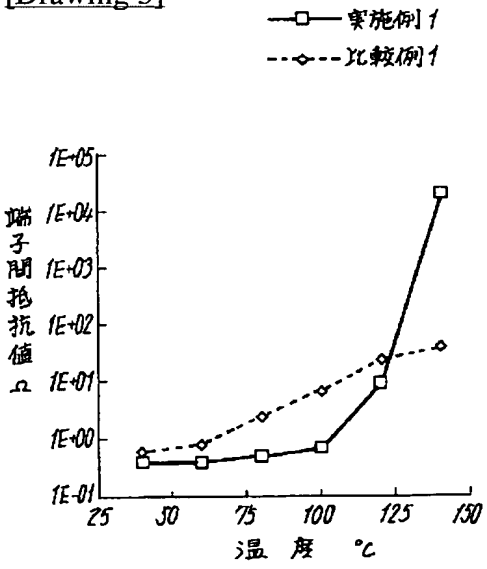
[Drawing 1]



[Drawing 2]



[Drawing 3]



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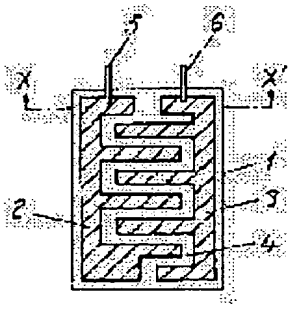

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(71)出願人　000005821
松下電器産業株式会社
大阪府門真市大字門真1006番地

(72)発明者　古山　静夫
大阪府門真市大字門真1006番地　松下電器産業株式会社内

(72)発明者　森本　光一
大阪府門真市大字門真1006番地　松下電器産業株式会社内

(72)発明者　長谷川　洋
大阪府門真市大字門真1006番地　松下電器産業株式会社内

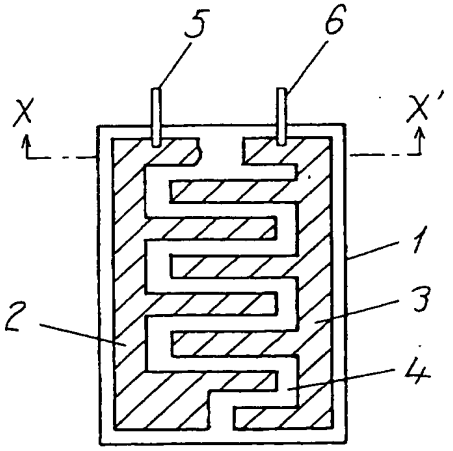
(74)代理人　弁理士　滝本　智之　（外１名）

(54)【発明の名称】　感温センサおよびそれを用いた電子機器

(57)【要約】

【課題】　本発明は、パソコンなどの電子機器の回路において、過電流を防止するために、高性能、高信頼性、低コストの感温センサを提供することを目的とする。

【解決手段】　絶縁基板１上に対向するように電極２，３を形成し、この電極２，３を含む絶縁基板１上に、新規な可撓性エポキシ樹脂に硬化剤、導電性金属粉末を分散させた感温膜４を形成して構成した。



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【特許請求の範囲】
【請求項１】　可撓性を有するモノマーと疎水性を有するモノマーとグリシジル基を有するモノマーを共重合させてなる樹脂と硬化剤の混合物に導電性粉末を分散した感温層を形成した感温センサ。
【請求項２】　可撓性を有するモノマーがテトラヒドロフルフリルアクリレートもしくはメタクリレートであることを特徴とする請求項１記載の感温センサ。
【請求項３】　疎水性を有するモノマーがフッ素を含有するアクリレートもしくはメタクリレートであることを特徴とする請求項１記載の感温センサ。
【請求項４】　グリシジル基を有するモノマーがグリシジルアクリレートもしくはグリシジルメタクリレートであることを特徴とする請求項１記載の感温センサ。
【請求項５】　硬化剤がエポキシ樹脂用の硬化剤であることを特徴とする請求項１記載の感温センサ。
【請求項６】　導電性粉末が金属粉末であることを特徴とする請求項１記載の感温センサ。
【請求項７】　請求項１記載の感温センサを用いた電子機器。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は、温度変化に応じて抵抗値が変化する感温センサおよびそれを用いた電子機器に関するものである。
【０００２】
【従来の技術】パソコンなどの電子機器の回路において、過電流を防止するためにある温度で抵抗値が急激に増大するサーミスタ、感温素子の使用が増大している。さらに２次電池のショート時の過熱破損防止にも用いられている。その中で小型電子機器に搭載するために小型、チップ化が必要な分野には米国特許第４，２３８，８１２号明細書に記載されているカーボン／ポリエチレンコンポジットが実用化されている。
【０００３】
【発明が解決しようとする課題】カーボンを導電粒子とした場合は、金属に比べて比抵抗が高いため大電流を使用する電源回路へ応用するのが難しく、より比抵抗の低い素子が望まれていた。
【０００４】さらに製造工程が簡単で高信頼性、低コストの素子に対する要望も強い。本発明は上記課題を解決するために、比抵抗が小さく高信頼性、低コストの感温センサおよびその感温センサを用いた電子機器を提供しようとするものである。
【０００５】
【課題を解決するための手段】本発明は導電性粉末を分散させた塗料を基板上に塗布後加熱硬化させるという簡便な方法によって製造可能な感温素子を提供するものである。
【０００６】その導電メカニズムは（１）ポリマーのガラス転移温度以下では分散された導電粒子同士の接触が多く低抵抗の状態を保持している。（２）温度が上昇しガラス転移温度を越すと、ポリマーの膨張が大きくなり導電粒子同士の接触が減少するということから成り立っている。ガラス転移温度を越えさらに温度が上昇することにより導電粒子同士の接触が極端に減少し、高抵抗状態になる。そして室温に戻れば、ポリマーの収縮により元の接触状態に復帰して低抵抗の状態に戻る。

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【０００７】このような特性を満たすためには本発明で使用する感温センサ用バインダ系は１００～１５０℃付近にガラス転移温度を有し、且つガラス転移温度以上での膨張率が室温時よりも２倍以上大きくなければならない。さらに降温時の復帰性に優れ、且つ導電粒子との分散性、各種基板に対する接着性に優れていることが必要であることはいうまでもない。
【０００８】本発明者らはこれらの諸要求を満たす可撓性ポリマーの開発に鋭意努力し、本発明に到達したものである。即ちテトラヒドロフルフリル（メタ）アクリレートとグリシジル基を有するモノマー及び必要であればフッ素含有モノマーを共重合させた新規ポリマーに導電粒子を分散させ、エポキシ樹脂用硬化剤を添加し塗料とする。基板上に塗布後加熱硬化させることにより再現性の良い感温センサを製造することができる。
【０００９】
【発明の実施の形態】以下、本発明の実施の形態について、添付の図面を用いて説明する。
【００１０】（実施の形態１）図１は本発明の感温センサの一実施の形態を示す上面図、図２は同断面図である。
【００１１】図１、図２において、１はセラミックなどからなる絶縁基板、２，３は絶縁基板１上に相対向するように設けられた銀からなる櫛形の電極、４はこの電極２，３を形成した絶縁基板１上に形成された感温膜で、この感温膜４は本発明の可撓性ポリマーに硬化剤を添加し、これに導電性粉末を分散させた構成となっている。５，６は上記電極２，３に接続されたリードである。
【００１２】以上のように可撓性ポリマーに導電性粉末を分散させた感温膜４を用いることにより、可撓性ポリマーの温度変化による膨張、収縮を分散された導電性粉末間の接触抵抗、つまり電気抵抗の変化として検出するものである。
【００１３】上記構成で、感温膜４の可撓性樹脂として特公昭６２－２２０９７号公報に記載されているようにテトラヒドロフルフリル（メタ）アクリレートを使用し、ビニルモノマーにエポキシ基を有するビニルモノマーを共重合させた新規エポキシ樹脂が適していて、さらにエポキシ樹脂用硬化剤を使用することにより再現性が得られることが見いだされた。本発明者らは１００℃～１５０℃の間で抵抗値が急激に増大する新規な樹脂系と導電粒子の組み合わせを有する感温センサを鋭意検討を

続けた結果、本発明に至ったものである。

【００１４】その特徴は新規な可撓性樹脂に、硬化剤及び導電粒子を添加し塗料化した後電極を形成した基板上に塗布、乾燥、硬化させて感温性塗膜を得る点にある。この作製法によれば、小型化と低コストを実現することが可能となる。さらに必要に応じて疎水性を増大させるためにフッ素含有モノマーを共重合させることもできる。本発明において使用される可撓性を与えるポリマー原料のモノマーとしては、テトラヒドロフルフリル（メタ）アクリレートが可能であるが、テトラヒドロフルフリルメタクリレートの方が共重合性の点からより好ましい。ビニルモノマーにエポキシ基を有するビニルモノマーとしては、グリシジル（メタ）アクリレートなどが適している。フッ素を含有する（メタ）アクリレートとしては一分子あたり２～５個のフッ素を含有する化合物、好ましくは３～４個を有する化合物が選ばれる。フッ素含有化合物として具体的にはトリフルオロエチル（メタ）アクリレート、テトラフルオロプロピル（メタ）アクリレート、ペンタフルオロプロピル（メタ）アクリレートなどがあげられる。

【００１５】可撓性をさらに付与するために、他のモノマー例えば、テトラヒドロフルフリル（メタ）アクリレート、２－エチルヘキシル（メタ）アクリレート、ラウリル（メタ）アクリレート、トリデシル（メタ）アクリレートなどの脂肪族（メタ）アクリレートを添加することも可能である。硬化剤としてはエポキシ樹脂用の硬化剤であれば基本的にはすべて使用可能であるが、好ましくは芳香族ジアミン、例えば４，４’－ジアミノジフェニルメタン、脂肪族ジアミン、例えば１，１２－ジアミノドデカンなどが用いられる。さらに芳香族ジアミンと脂肪族ジアミンを併用してもよい。導電性粉末としては、銀粉、銅粉などの金属粉、さらにはそれらの混合物を使用することができる。粒径は１０ミクロン以下で１ミクロン以上好ましくは３～５ミクロンの球状粉が望ましい。抵抗値の再現性のためにフレーク状または樹枝状粉を添加することもできる。

【００１６】導電粒子の添加量は樹脂量に対して３０～５０Ｖ%の範囲内で選ばれ、所望の抵抗値とその温度変化率及び復帰性を勘案して決定される。最適値を越えれば変化率が下がり、少なければ初期抵抗値が上がるとともに温度変化に対する復帰性が悪くなる。本発明の感温センサは、上記組成の樹脂、導電粒子、硬化剤と必要最小量の溶剤を加えよく分散させた後、あらかじめ絶縁基板１の上に設けられた櫛形の電極２，３の上に積層し、加熱硬化させて製造される。このようにして得られる感温センサの電極２，３としては、導電性ペーストおよび通常の電極材料を使用することができる。

【００１７】以下、本発明をさらに具体的な実施例を用いて説明する。

【００１８】【実施例】（実施例１）テトラヒドロフルフリルアクリレート６２．４８ｇ、グリシジルメタクリレート８．５４ｇ、重合開始剤としてアゾビスイソブチロニトリル（ＡＩＢＮ）０．５ｇをシクロヘキサノン１０６．５ｇに溶解し、窒素気流中で８０℃、５時間加熱して共重合させポリマー溶液を得た。この樹脂溶液（固形分濃度４０重量%）４．５ｇに導電性粒子として球状銀粉（平均粒径３～４ミクロン）８ｇ、４，４’－ジアミノジフェニルメタン（ＤＤＭ）０．２ｇを加えてよく混合する。次に三本ロールで十分混練分散してペーストとする。図１に示す櫛形銀電極を形成したセラミックの絶縁基板上に得られたペーストを塗布し、１５０℃で１時間加熱硬化させて感温センサを作製した。

【００１９】図３に感温センサの感温特性を示す。横軸が温度で縦軸が端子間抵抗値である。Ａの曲線が実施例１の感温特性である。

【００２０】（比較例１）エポキシ樹脂としてエピコート８０６（油化シェルエポキシ（株）社商品名）１．２５ｇ、硬化剤のＤＤＭ０．７５ｇ、導電性粒子として球状銀粉（平均粒径３～４ミクロン）８ｇを加えてよく混合する。次に三本ロールで混練分散した後、実施例１と同様にして感温センサを作製した。なお膜厚はほぼ同等になるように塗布した。図３のＢ曲線が比較例１の感温特性である。

【００２１】（実施例２）テトラヒドロフルフリルメタクリレート５７．８７ｇ、テトラフルオロエチルメタクリレート１１．１６ｇ、グリシジルメタクリレート８．５４ｇ、重合開始剤としてＡＩＢＮ０．５８ｇをシクロヘキサノン７７．５７ｇに溶解し、窒素気流中で８０℃、５時間加熱して共重合させポリマー溶液を得た。

【００２２】この樹脂溶液（固形分濃度５０重量%）２．９８ｇに導電性粒子として球状銀粉（平均粒径３～４ミクロン）８．３ｇ、ＤＤＭ０．２１ｇ、溶剤としてベンジルアルコール０．８ｇを加えてよく混合する。次に三本ロールで十分混練分散してペーストとする。このペーストを用いて実施例１と同様にして感温センサを作製した。

【００２３】作製した感温センサの吸湿による抵抗値変化をみるために相対湿度９５%ＲＨの槽中に２４時間放置し、抵抗値上昇率を評価したところ１%であった。

【００２４】（比較例２）テトラヒドロフルフリルメタクリレート６８．０８ｇ、グリシジルメタクリレート８．５４ｇ、重合開始剤としてＡＩＢＮ０．５８ｇをシクロヘキサノン７６．６２ｇに溶解し、窒素気流中で８０℃、５時間加熱して共重合させポリマー溶液を得た。

【００２５】この樹脂溶液（固形分濃度５０重量%）を使用して実施例２と同様にして感温センサを作製した。この感温センサの吸湿による抵抗値変化率は３%であった。

【００２６】図３より、実施例１の感温センサの温度に

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よる抵抗値変化率は比較例１の場合に比べ、格段に優れているのは明らかである。これは可撓性ポリマーの違いに由来するものである。さらに実施例２ではポリマー分子内にフッ素原子を有しているため、比較例２より吸湿性が小さくなるので抵抗値上昇が小さくなっている。

【００２７】以上に述べたごとく、本発明の感温センサは性能と信頼性及び印刷により製造できるというユニークな感温センサである。

【００２８】本発明の特性評価は櫛形電極上での塗膜について実施したが、サンドイッチ構造でも同様の効果が得られた。

【００２９】

【発明の効果】以上のように本発明は、球状導電金属粒＊

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＊子を新規な可撓性エポキシ樹脂に含有させたペーストを塗布し、加熱硬化させることにより、高性能、高信頼性で低コストの感温センサを提供するものである。

【図面の簡単な説明】

【図１】本発明の感温センサの一実施の形態を示す平面図

【図２】同図１のＸ－Ｘ′線における断面図

【図３】同感温センサの温度特性を説明する特性図

【符号の説明】

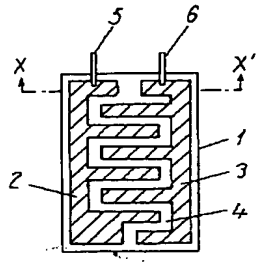
１　絶縁基板

２，３　電極

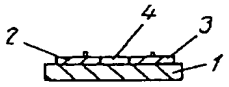
４　感湿膜

５，６　リード

【図１】



【図２】



【図３】